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Interaction Dynamics of Cooperative Alliance Relationship in Construction

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Abstract
Construction alliance formation has been proliferating both in the industry and research. However, extant research in cooperative alliance relationship has been static and has underplayed the complexities and dynamics of cooperation. It is still a myth that some alliances successfully engineer cooperation among partners while some fail. The process and mechanism to built cooperative alliance relationship has been largely ignored. This paper addresses these issues by adopting a social network approach to examine cooperative alliance relationship from two different aspects: (1) engineering of cooperation by interaction; and (2) dynamic evolution of cooperation. Construction project is consisted of interconnected network of human and physical resources and the interactive relationship between them. This study argues that cooperation in alliance is fostered by frequent communication. Communication structure changes when construction project moves to different construction phase. Hence, this study also argues that alliance relationship evolves alongside with different construction stages. Case study approach has been adopted. Relational data was collected through documentary evidences and questionnaire survey. A versatile social network analysis software package UCINET 6.0 was used for data analysis.

Keywords
Construction alliance, cooperative relationship, interaction dynamics, communication, social network analysis

1. Introduction

Construction industry has experienced a paradigm shift from hierarchical, top-down approaches to a more cooperative network approach (Bennett, 2000). Construction alliances in the form of partnering have been formed to induce cooperation in construction projects. Research on partnering has been abundant yet ubiquitous and static. Conversely, partnering is a dynamic and iterative process which can change drastically across project cycle (Bresnen and Marshall, 2002). The complexities and interaction dynamics of project team in partnering relationship has been ignored. Cooperation has been presumed to be an existent in partnering relationship no matter how effectively it has been put across the whole project team. As advocated by Bresnen and Marshall (2002), partnering can be a management tool to engineer cooperation in the short term and systematically construct it in the long term, provided that there are right supporting mechanisms. This paper argues that construction of successful cooperative alliance relationship has to rest upon an effective and efficient communication network of project team members.

Partnering has been a recognised method of improving communication mechanisms; however, there has been limited attempt to examine how it works. Communication research on partnering is scant, for example, Cheng *et al* (2001) proposes a communication mechanism of construction alliance without empirical implication. This paper examines cooperative alliance relationship in construction industry from a social network perspective taking into account the influence of structure and position of a network.

2. Cooperation in Construction Alliance

Adversarial project team relationship has long been a chronic problem of the construction industry. It is believed that one of the primary reasons is communication inefficiency and ineffectiveness (Cheng, et al, 2001) which would lead to dramatic acceleration of conflicts and disputes. Traditional hierarchical project management highly restricts information flow. Instructions come from top management from client or the Architect and disseminates downward to the contractor and subcontractors at working level. Information flow and feedback loop are long and indirect. It is such restricted pattern of communication that results in misunderstanding and disputes. Invisible inter-organizational communication barrier exists among different parties. Paper warfare is disastrous to project operation, wasting both time and money.

Partnering being an informal construction alliance has recently been adopted by some large developers and contractors in Hong Kong to bring about cooperation. Cooperation is a dynamic process in which individuals react to the behaviours of others in a timely and speedy manner. Cooperative behaviour is formed by reciprocal moves that lead to win/win conclusion (Lazar, 2000). Project team relationship is formed by the way and pattern that people interact with one another upon decision making or conflict resolution.

The growth of inter-organizational relationships is fostered by frequent communication to formalize the relationship and build consensus about the terms of the relationship among the parties involved (Van de Ven and Walker, 1984). This is particularly true for construction industry in which construction practitioners are nested together by dynamic construction projects. This study examines the interaction dynamics of construction alliance in terms of communication. Besides, cooperative alliance relationship depends upon a complex and dynamic interplay of formal integrative mechanisms and informal social processes (Bresnen and Marshall, 2002). Bresnen and Marshall (2002) suggest that formal mechanisms such as organizing workshop, signing charter inculcate collaborative norms and values. In addition, there are complementary economic and social supporting systems to continuously drive the development of cooperation, making cooperative alliance relationship dynamic rather that static.

Discussion on behavioural characteristics of partnering has been superficial and their development process has not been taken into account until recent research by Lazar (2000) and Cheung et al (2003) which explain trust building and cooperative behaviour by game theory. They both acknowledge that cooperative behaviour is associated with frequent interactions. This study adopts a social network perspective to examine how team members in partnering project interact with each other. This study also takes into account of the dynamic project life cycle of construction, from design stage, construction stage to completion stage. Partnering would evolve alongside with the project life cycle.

3. Research Methodology

3.1 Social network analysis (SNA)

A social network, can be defined as “a set of nodes (e.g., persons, organizations) linked by a set of social relationships (e.g., persons, organizations) of a specific type.” Social network analysis is defined as ‘a specific set of linkages among a defined set of persons, with the additional property that the

characteristics of these linkages as a whole may be used to interpret the social behaviour of the persons involved'(Mitchell, 1969, p.2). It is a method of research for identifying the communication structure in a system, in which relational data on communication flows are analyzed using some type of interpersonal relationships as the units of analysis (Rogers and Kincaid 1981: 141). Network analysis assumes no way of knowing in advance how combinations of relations are formed and analyses overall relations in an inductive attempt to identify behaviour patterns and the groups or social strata that correlate with those patterns. It seems to be the right tool to analyze relation and communication structure (Forse 1999). It is expected that the working relationship under investigation is not only influenced by implementing partnering but also by the social structure. Social network analysis helps to reveal whether partnering brings about collaborative relation in a social context. Moreover, it is possible to identify clusters within the network and specify the roles people play in the network in relation to these clusters. However, the limitation of social network analysis is that the data produced is purely numerical. In order to mitigate against this deficiency, findings of social network analysis will be supported and explained by qualitative findings obtained through interviews.

There are many dimensions of social network analysis. This study would focus on looking at centrality of network. The three most common measures of centrality are: degree, closeness, and betweenness. Degree centrality is the simplest form of centrality and comes in two forms: indegree and outdegree. The indegree of an actor in the network is the number of other people who choose that actor in the particular relationship. The actor is the receiver of information. Outdegree is the number of people chosen by the actor. It reflects the actor as source of information and measures how influential the actor may be (Hanneman, 2002). Closeness measures of centrality account for both direct and indirect links in indicating how "close" a person is to all other persons in the network. It is generally calculated by making an inverse to sum of the lengths of the shortest paths (geodesics) from a point to all other points. Betweenness measures of centrality calculate the extent to which actors fall between pairs of other actors on the shortest paths (geodesics) connecting them (Freeman, 1979). People have high centrality would have the power to withhold or distort information in transition. Whereas the closeness measure represents avoiding the control of others, the betweenness measure represents controlling, or increasing the dependence of others.

3.2 Case Study

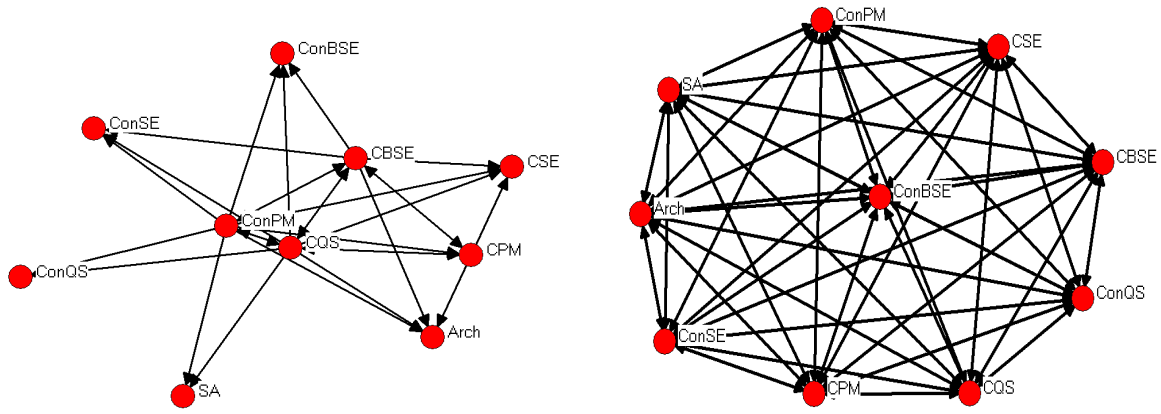
Case study is a powerful qualitative research approach which allows the research findings to be intrinsically linked to the data. It also allows the research process 'to retain the holistic and meaningful characteristics of real-life events, such as individual life cycles, organizational and managerial processes, neighbourhood change, international relations, and the maturation of industries' (Yin, 1994). Construction projects with partnering are identified for in-depth investigation. Data is collected through documentary evidence, semi-structured interviews and a questionnaire survey. The reason for using this range of methodologies is to minimize any bias that could arise from the use of only one such methodology and to generate data (Loosemore, 1995).

Since it would be extremely difficult, if not impossible, to examine relational ties of everyone in a construction project, a role boundary of ten key players in typical construction project is delineated. This role boundary also acts as the roster for actors to choose with. They are from the client side: project manager (CPM), architect (Arch), quantity surveyor (CQS), building services engineer (CBSE) and structural engineer (CSE); and from the contractor side: project manager (ConPM), site agent (SA), quantity surveyor (ConQS), building services engineer (ConBSE) and structural engineer (ConSE). Respondents are asked the question 'How frequently do you contact with the following parties in different phases of the project?' Data is measured at Likert Scale from 1 to 5, with '1' representing very infrequent and '5' representing very frequent. Relational data collected will be analysed with UCINET 6.0. It is a versatile software package which allows the computation of various network measures.

4. Results and Discussion

The case study presented here is part of a large infrastructure project of railway construction in Hong Kong with contract sum of about HK$ 300 million (US$ 37.5 million). Duration of the project is 42 months. This project includes modification work to an existing railway station, and connecting the concourse to another railway line. Since this project is risky and complicated, target cost approach has been adopted as contract strategy and partnering was introduced into the project in design stage to have early involvement of the contractor. To improve communication, partnering brings the project team together in the same office to work as a team and regular partnering meetings are held to resolve problems through open discussion.

Fig. 1 shows the dynamic interaction patterns of ten key project team members which change from design to construction stage. In design phase, before the contract award, communication links focus in the client side and contractor's participation is relatively low. In this stage, the contractor preliminarily set up the project team but most of them are not involved in the construction phase. Contractor's project manager acts as the prime contact point to the client to deal with design issues. In construction phase, actors have both intra-organizational and inter-organizational reciprocal communication links and they work together as a team.



Design Phase **Construction Phase**

CPM = Client Project Manager
Arch = Architect
CQS = Client Quantity Surveyor
CBSE = Client Building Services Engineer
CSE = Client Structural Engineer

ConPM = Contractor Project Manger
SA = Site Agent
ConQS = Contractor Quantity Surveyor
ConBSE = Contractor Building Services Engineer
ConSE = Contractor Structural Engineer

Fig. 1 Sociograms of Communication Network in Construction Alliance

Fig. 2 shows degree centrality of communication in both design and construction phase. In design phase, outdegree centrality of communication is mainly focused on client side: project manager (CPM), quantity surveyor (CQS), and building services engineer (CBSE). They are the major sources of information. However, it is interesting to find that the contractor's project manager (ConPM) also has high outdegree centrality and other project participants from contractor side have indegree centrality. This means that contractor is actively involved in design stage. Pre-tender stage partnering improves communication between client and contractor and it enables early involvement of contractor to deal with design problems and work out feasible method statements. In construction phase, both indegree and outdegree centrality greatly increase and there is no one being isolated. Frequent interaction enables learning and behaviour tune-in to work as a team and build up collaborative alliance relationship.

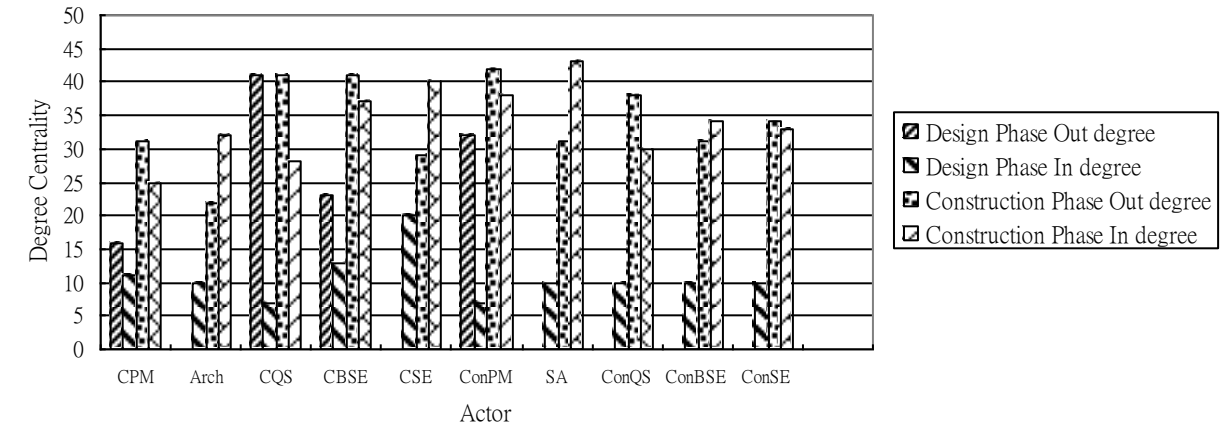


Fig. 2 Degree Centrality of Communication

With reference to Fig. 3, in closeness centrality of communication in design phase is more or less the same at low level (<20). However, high out closeness concentrates in client's project manager (CPM), quantity surveyor (CQS) and client's building services engineer (CBSE) and contractor's project manager (ConPM) in design phase. This means that their geodesic distances are very short and they can communicate and interact directly with other team members in the network without passing through any intermediary. Communication tends to be direct and efficient. In construction stage, both in and out closeness of communication are high and evenly spread. This reflects that communication in construction stage is more direct and information can flow more freely. Project team members can get direct access to one another to communicate freely and there is no inter-organizational communication barrier among the actors. The project team successfully built up a cohesive team.

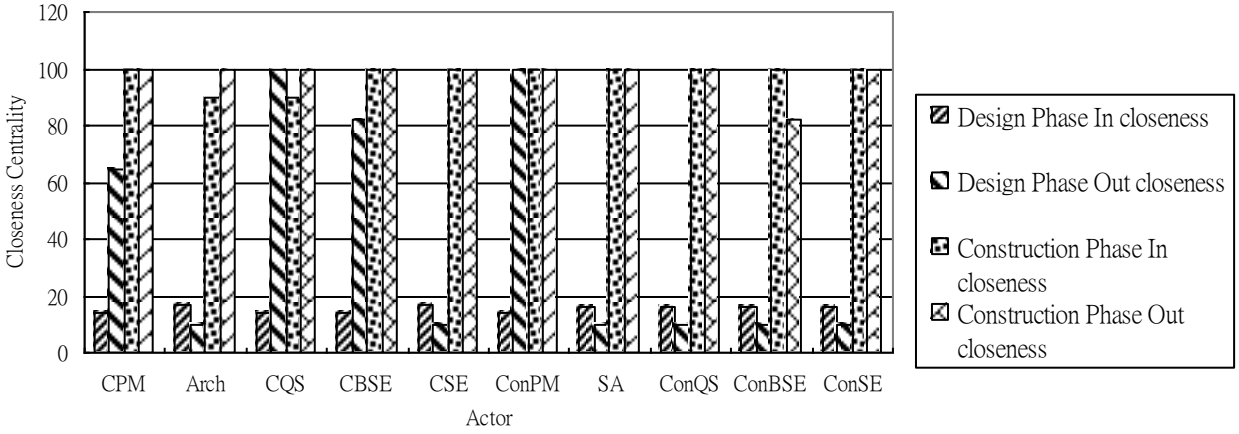


Fig. 3 Closeness Centrality of Communication

Fig. 4 reveals that, in design phase, the highest betweenness centrality goes to client's quantity surveyor (CQS), the next is client's building services engineer (CBSE) and then contactor's project manager (ConPM). Other parties have zero betweenness. Effective communication in design phase has to be dependent on CQS. He falls on the geodesic paths between other pairs of actors in the network and therefore has the power to control or manipulate information. In construction stage, betweenness centrality is low and more evenly spread. This may reflect that in construction stage there is no dominant party to get hold of information. Hence, actors are more interdependent and they must cooperate with each other to acquire necessary information to make decision and achieve project performance.

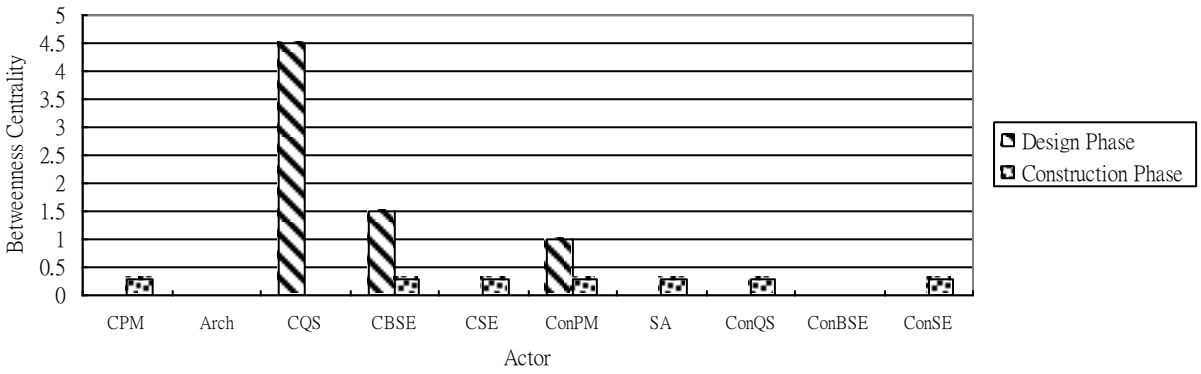


Fig. 4 Betweenness Centrality of Communication

5. Conclusion

To conclude, social network analysis successfully visualizes the pattern of interaction and provides quantitative analysis. Interaction pattern is dynamic and changes in different construction phase. Collaborative alliance relationship is built up from efficient and effective communication network. More interaction, more direct information flow and more interdependency on communication would bring about cooperation. Partnering forms an informal alliance relationship which facilitates an environment for open communication and team-building.

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